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Collection, Treatment, and Disposal of Sludge from Small Communities U.S. Experience

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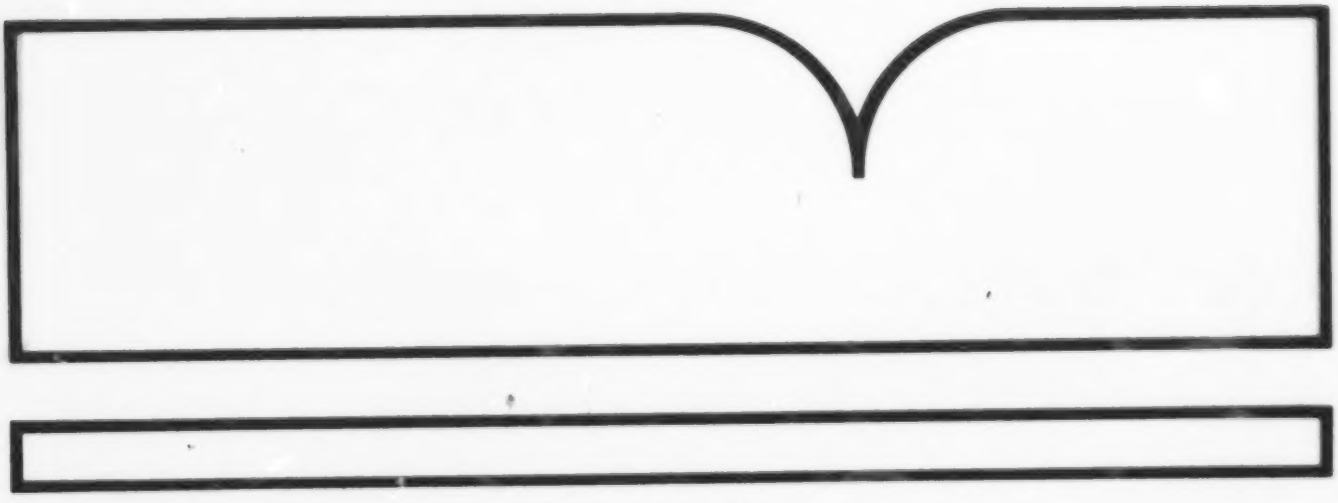

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COLLECTION, TREATMENT, AND DISPOSAL OF SLUDGE FROM SMALL COMMUNITIES: U.S. EXPERIENCE

by

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16. ABSTRACT

Sludge treatment represents almost half the cost of wastewater treatment at many facilities in the U.S. Although sludge problems are of serious concern everywhere, they are different for different locations. The approach to sludge handling and the solution to problems depends on geography, climate, population, proportion and nature of industrial wastes in the wastewater, and local details (e.g., proximity of hills, rivers, residences, farmland, landfills, strip-minded land). The net result has been different approaches to sludge handling, and great variety in processes and equipment.

A breakdown of small community sludge management facilities in the U.S. indicates that the most popular method of sludge stabilization for facilities of less than 1 mgd (0.044 m^3/s) capacity is aerobic digestion, followed closely be anaerobic digestion, primarily at facilities near the high end of the range. The overwhelming choice for dewatering is sand drying beds, and for final disposal, land filling and spreading. These practices have evolved over several decades for a variety of reasons.

Sludge drying beds are the overwhelming choice in small treatment plants for dewatering excess sludge. This is primarily due to the general availability of land and the simplicity of operation of drying beds.

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Sludge treatment represents almost half the cost of wastewater treatment at many facilities in the U.S. Although sludge problems are of serious concern everywhere, they are different for different locations. The approach to sludge handling and the solution to problems depends on geography, climate, population, proportion and nature of industrial wastes in the wastewater, and local details (e.g., proximity of hills, rivers, residences, farmland, landfills, strip-mined land). The net result has been many different approaches to sludge handling, and great variety in processes and equipment.

A breakdown of small community sludge management facilities in the U.S. indicates that the most popular method of sludge stabilization for facilities of less than 1 mgd (0.044 m^3/s) capacity is aerobic digestion, followed closely by anaerobic digestion, primarily at facilities near the high end of the range. The overwhelming choice for dewatering is sand drying beds, and for final disposal, land filling and spreading. These practices have evolved over several decades for a variety of reasons.

Aerobic digestion has generally been favored in smaller facilities owing to its low initial cost and simplicity of operation. Prior to the last decade, the high energy demand of these systems was not a major concern owing to low energy costs. More recently, higher energy costs, longer detention times required in colder climates and poor removal of bacterial pathogens and indicator organisms have reduced the enthusiasm of designers and regulatory officials toward these systems.

Sludge drying beds are the overwhelming choice in small treatment plants for dewatering excess sludge. This is primarily due to the general availability of land and the simplicity of operation of drying beds. Generally, a liftable cake (<70% moisture content) is obtained in 1 to 4 weeks, depending on climatic conditions depth of loading, and prior sludge conditioning. Loading rates or, conversely, sizing requirements vary from 0.5 to 12 ft^2 (0.05 to 1.1 m^2) per capita in the U.S. Presently, several states using the lower end of this range and Japan are reevaluating these criteria owing to a significant number of reports of inadequate performance by these systems.

Sludge disposal from small treatment facilities is generally to land spreading, landfills, or trenches. Farrell (1) estimates that fully 65% of all U.S. municipal wastewater treatment plant sludge is disposed to the land (surface and subsurface), therefore in plants of less than 1 MGD (0.044 m^3/s) capacity, this figure should be significantly higher. Sludge disposal regulations promulgated in the last decade (and potentially more stringent regulations under consideration at this time) have placed severe restrictions on these practices which may effect reconsideration or change in sludge processing steps required to continue these disposal practices in the future. Since land disposal is likely to remain the only viable disposal option other than transport to larger regional facilities, it is probably that any necessary changes will be made to comply with the regulations.

Over the past few years the Wastewater Research Division of the Water Engineering Research Laboratory of USEPA has investigated some sludge

treatment systems which appear promising in supplementing and/or succeeding the normally applied systems described above for small municipal wastewater treatment facilities. Two notable systems are autothermal thermophilic aerobic digestion and vacuum-assisted sludge drying beds.

The vacuum assisted sludge dewatering bed (VASDB) process, a U.S. technology devloped in the mid-1970s, appears to be applicable mainly to small and medium sized wastewater treatment systems. This dewatering technology incorporates the application of a vacuum to the underside of a rigid, porous media plate grid system onto which chemically conditioned wastewater treatment plant sludge has been placed. The vacuum forces free water to pass through the media plates while the plate system, itself, acts as a septum to retain essentially all of the sludge solids. In actual practice, a gravity drainage time interval is utilized to allow for the non-mechanically assisted removal of a portion of the free water through the media plates. This free drainage period normally commences as soon as conditioned sludge is placed on the media plates and is allowed to continue for 0.5 to 3 hours. After this free drainage period, the vacuum pump is activated to provide for the mechanically assisted removal of additional free water. Upon completion of the vacuum-induced free water removal cycle and an optional air drying time interval, the partially dewatered sludge solids are removed from the media plate grid system, usually with a front-end loader. Cleaning of the plate system is next undertaken by rinsing residual sludge fines and associated polymer from the upper surface of the media plates with high pressure water. After a desired plate drying period, the system is ready for another application of sludge.

During the course of an EPA investigation (2) twelve operational municipal VASDB systems were visited. These site visits were undertaken to note system design details, observe the systems in operation, collect available data on system performance and costs, and obtain information from the system operators on possible design and/or operational improvements.

The results of the study (2) showed that the average capital costs were \$1,323/m^2 (\$123/ft^2) and \$1,679/m^2 (\$156/ft^2) for uncovered and totally enclosed VASDB installations, respectively, with operation and maintenance costs of \$12 per 1,000 kg (\$111/ton) of dry solids at a loading rate of 9.8 kg/m^2 per cycle (2 lb/ ft^2 per cycle). Performance data indicate that the solids cake produced had a moisture content between 87 and 89 percent. In comparing total costs of a VASDB installation to a sand drying bed one must recognize the difference in moisture content of cake solids. However, assuming that differences in disposal costs related to this moisture content differential are minimal, it appears that the above costs for an enclosed VASDB can result in significant savings when compared to enclosed sand drying beds loaded at normally successful rates.

The Autothermal Thermophilic Aerobic Digestion system is an aerobic digestion process that operates within a thermophilic temperature range (40°C to 80°C) without the introduction of supplemental heat. The basic elements of the heat balance are shown in Figure 1. The key elements are an efficient aeration device to minimize latent heat loss in the exiting gas stream, effective insulation to minimize heat loss to the environment and an effective scum cutter to minimize the volume of resulting foams in the reactor.

To date the process has been utilized primarily in West Germany and Switzerland. The EPA study (3) entailed evaluation of several of those installations and concluded that the process was relatively simple to operate; it regularly produced >40 percent volatile solids destruction and an effluent which met the most stringent U.S. regulatory requirement (i.e., a Process to Further Reduce Pathogens); and it was more cost-effective than either aerobic or anaerobic digestion.

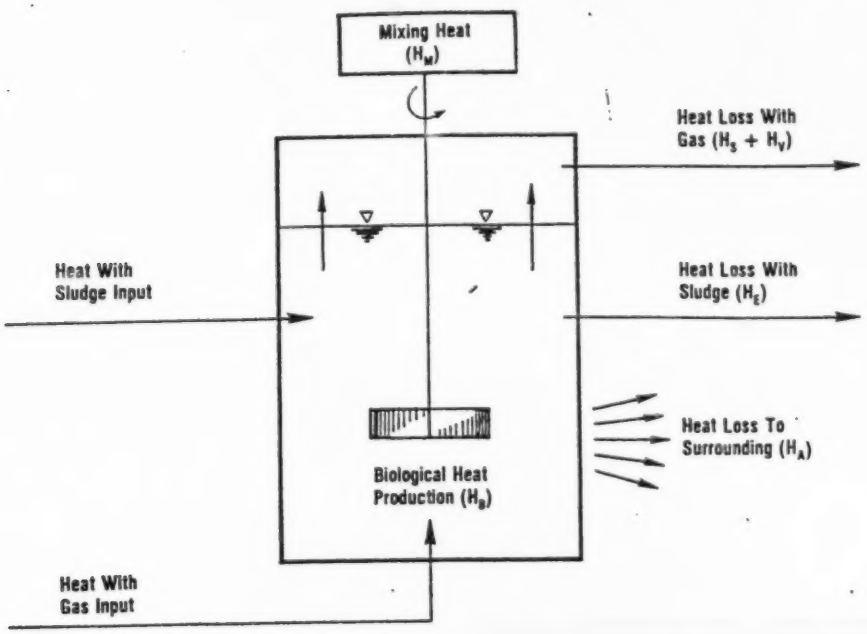

Figure 1. Heat balance components for aerobic digestion.

REFERENCES

1. Farrell, J.B. United States Practice in Sludge Treatment and Disposal. Proceedings of Symposium on Land Disposal of Municipal Sludge, Madrid, Spain, EPA Publication No. 600/D/86-043, NTIS No. PB 86-166006/AS, 1986.

2. Condren, A.J., A.T. Wallace, I.A. Cooper, and J.F. Kreissl. Design, Operational and Cost Considerations for Vacuum Assisted Sludge Dewatering Bed Systems. Draft report under review, 1986.

3. Deeny, K., J.A. Heidman, and J.E. Smith. Autothermal Thermophilic Aerobic Digestion in the Federal Republic of Germany. Paper presented at 40th Annual Purdue Industrial Waste Conference, 1985.

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